LUBRICATION

A Technical Publication Devoted to the Selection and Use of Lubricants

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The Art of Printing—Its Relation to Lubrication

WHEN The London Times was first printed by machinery at the rate of some one thousand copies per hour, early in the nineteenth century, the publishing world marvelled at the mechanics of the process. It was a radical departure from the hitherto cumbersome methods of hand printing, and the rate of output sufficed to meet the requirements of the period, even when the news of the Battle of Waterloo was eagerly awaited by all England.

Later the mechanics of the process were improved and naturally with the advancement of rail transportation the circulation of the news became more in demand. So speeds of press operation were increased. Not until Hoe perfected his relatively high-speed news-press in 1871 were mechanisms of any especial intricacy applied. Hoe called upon his ingenuity to assemble a variety of gears, to resort to closer bearing fits, and to build the forerunner of the modern news-press in such a manner as to require careful lubrication for its maintenance.

Fortunately, the petroleum industry had developed by then to a degree to enable production of a dependable type of lubricating oil which could take the place of the more costly and more unstable animal or vegetable oils. Naturally, these petroleum derivatives soon found a place in the press room.

Several years had still to pass, however, before other scientists developed mechanical methods for automatic handling of these lubricants. The World War had to come and go before the modern press was fully perfected to include the anti-friction bearing, pressure grease lubrication and force-feed circulation of lubricating oils.

DEVELOPMENT OF THE ART

Caxton is credited with some of the earliest developments in the art of printing. Machinery was first used during his life in the fifteenth century. Naturally, these machines were crude, slow and cumbersome, but they served a useful purpose in satisfying the requirements of a limited class of readers and established a foundation for one of our most interesting industries. Caxton, however, developed only the hand-operated press. In the later applications of power, steam was first used to some extent. Speed was not attained until electric power was incorporated.

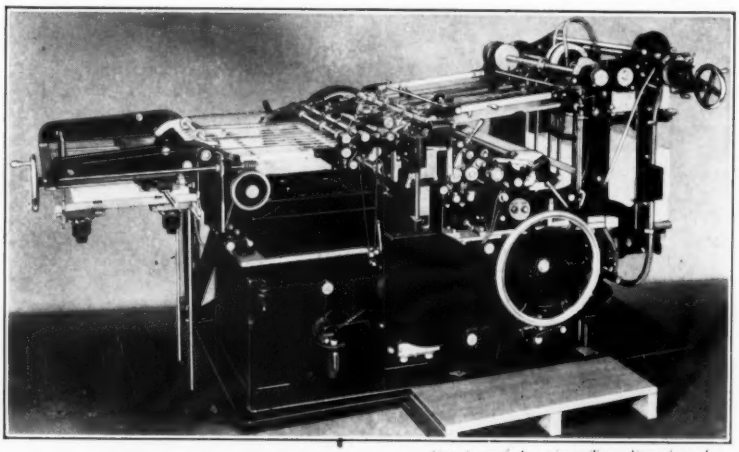
The amount of speed required will depend upon the nature of the work to be done, and the type of press employed. To meet these conditions, three types of machines have been developed, viz.:

The platen,
The flatbed, and
The rotary press.

All serve the one primary purpose of impressing printed characters from a plate or form onto a single or continuous sheet of paper.

The platen press is the most simple mechanism; it is a device used largely for short run mailing pieces such as cards, envelopes, or circulars where some fifty thousand impressions

will be maximum. In such service it is economical, due to its simplicity, ease of operation, and the rapidity with which the form can be made ready and registered. A platen press can also be easily changed from one job to another, it is relatively a one-man machine, and requires but little power and floor space.



Courtesy of American Type Founders, Inc.

Fig. 1—Showing a 17 x 22 Kelly press. Note in particular the Bijar lubricator and gauge located under press column at lower left.

Publication printing, however, requires a more complex mechanism to meet modern production requirements in newspaper and magazine work. Flat bed cylinder presses and rotary presses are best adapted to such service. Speed of production is one of the most important factors in this phase of the printing industry, hence the acceptance of the rotary press with its ability to turn out thousands of impressions per hour.

PRESS CONSTRUCTION

The pressman is fully conversant with the construction of his machinery. Those who may have to deal with lubrication, however, will be interested in a brief description as an introduction to discussion of the application of lubricating equipment.

In the cylinder press, the paper receives its impression by passing over one or more impression cylinders in contact with either a flat bed or similar cylinder which carries the plates of typographical matter. It is possible to print in either one or two colors on one side of the sheet on a flat bed press, or to otherwise so design the press as to print in one or two colors on both sides of the paper in one operation.

Flat Bed Press Operation

In the modern flat bed press, the paper is fed to the press guides in individual sheets, and the plates or type matter lie perfectly flat on the press bed, being securely locked in place. The paper is carried by a suitable device to the impression cylinder which in turning passes each sheet through in contact with the type bed, to bring about the impression.

The type bed is fitted with two or more sets of steel anti-friction rollers which travel on steel tracks installed the full length of the press. In operation the bed travels backward and forward periodically, being actuated by a suitable crank mechanism driven by gears from the main drive of the machine. As the direction of motion of the type-bed is changed the impression cylinder is automatically lifted from contact by means of suitable cam mechanisms, in order to permit it to move continuously in one direction. Two revolutions of the cylinder are made to one backward and forward movement of the bed on most flat beds.

Inking Requires a Unique Mechanism

The petroleum engineer will be especially interested in the inking device, since light petroleum oils form the base of certain grades of printing ink. This ink is handled via a fountain, several distributing rollers, an ink plate which moves back and forth with the type bed, and several form rollers. Elastic composition and hard metal surfaces alternate, the fountain, ink plate, and lateral distributors being metal. The ink rollers, form, ductor and regular distributors consist chiefly of glue and glycerine, although rubber or other composition material may also be used. There are two sets of inking devices in the flat bed press designed for two-color work or the simultaneous printing of both sides of the paper in one color.

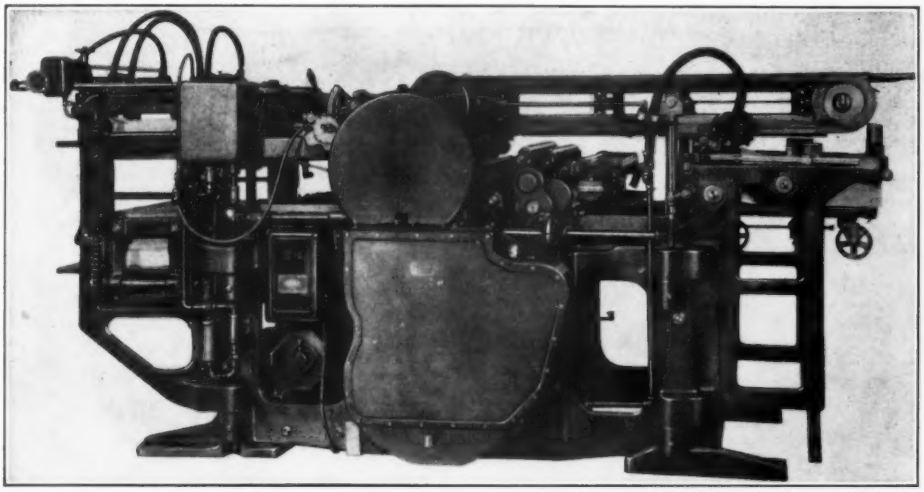
Printing ink is rather tacky, so in order to insure as perfect and uniform distribution as possible the several distribution rollers through which it is passed before being applied by form rollers to the type plates, are usually arranged to move from side to side across the press with respect to each other during rotation. Their actual distance of travel is only a few inches, but the combination of rolling and sliding contact serves to effectively break up any larger particles of ink to suitable fineness and distribute it evenly along the length of each succeeding roll. The reciprocating motion of these vibrating rollers is brought about by means of special cam mechanisms.

Air Springs in turn Conserve Energy

In the flat bed press change of motion takes place rapidly, the bed coming to an absolute stop on dead center for each revolution of the cylinder. This type of press is, therefore, generally equipped with from two to four air springs or cushions located at each end of the machine in order to afford a temporary storage of energy when the bed approaches the end of its stroke. This accumulated energy serves to aid in starting the bed in the opposite direction to reduce the power required; it also relieves the pressure and shock on the driving mechanism during this period of stopping and starting.

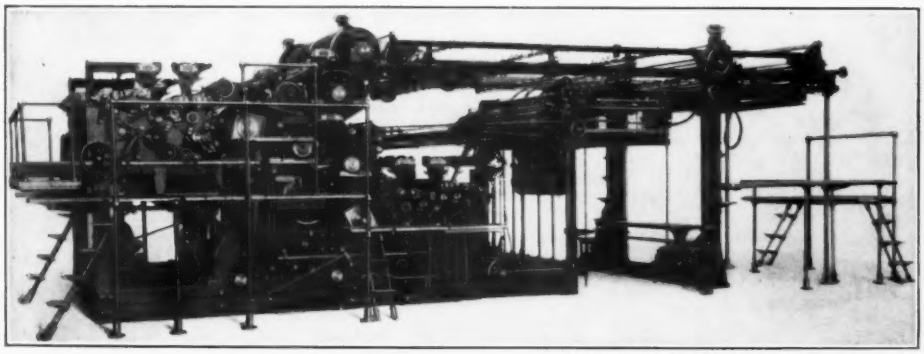
To enable an air spring to function effectively, the piston must fit snugly in the cylinder, and yet be capable of entering with perfect freedom. Leakage of air would, of course, be a detriment; therefore, it is customary to equip the end of the piston with a leather cup packing. When properly installed and of sufficient pliability to conform to any minor undulations in the surface of the cylinder, this cup serves to trap the contained air upon entering, and to expand almost immediately due to the increasing pressure encountered.

An effective seal is thus attained and the full benefits of the compression derived. Inasmuch as this seal will be practically entirely governed by the condition and manner of setting of the leather packing, it is most important to observe the greatest of care in handling the leather. Primarily it must be properly centered on the piston, capable of readily entering the cylinder, and quite soft and pliable.



Courtesy of Miehle Printing Press and Mfg. Co.

Fig. 2—Gear side of the Miehle horizontal press. All inner bearings are oiled via tubes from oil reservoirs. Wick feeds are used in many cases to control oil flow. Gears are bath lubricated by medium machine oil; note oil level control at base of case.



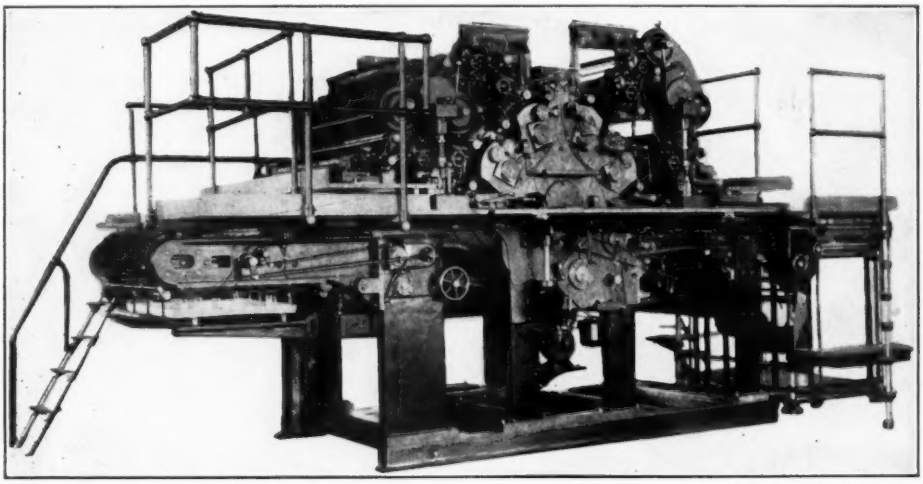
Courtesy of The Babcock Printing Press Mfg. Co.

Fig. 3—The Babcock two-color sheet fed rotary press. This machine is equipped throughout with multiple bottle feed oilers and pressure grease fittings. Dependable lubrication is thereby assured provided operators observe a regular routine for replenishing supply of lubricant.

Lubricating the Spring Seals

To attain these objectives, afford as perfect a seal as possible, and reduce resistance, lubrication has been found to be of the greatest benefit. In other words, the leather as well as the cylinder must be properly lubricated. The leather is treated by periodic soaking or boiling in neatsfoot oil.

The walls of the cylinder, however, are best lubricated by a medium bodied, average melting point grease. A suitable film of such a lubricant will not only reduce rubbing friction to a marked extent, but also will insure against leakage of air.



Courtesy of C. B. Cottrell and Sons Co.

Fig. 4—A four-color sheet fed rotary press of Cottrell design. At the top-side and lower left below the platform are shown assemblies of centralized lubricating appliances which serve the various roller bearings and other mechanisms.

The Main Gear or "Star Wheel"

The main driving gear or "star wheel" is probably the most important piece of mechanism in a flat bed press from the viewpoint of lubrication. This gear carries the entire load of the machine and is subjected to heavy duty, considerable wear and oftentimes lack of attention due to its more or less inaccessible location beneath the type bed. The star wheel will receive especially severe service in cases where the air cushions are not functioning properly or where the pressure is not absolutely equalized. The abnormal jar resulting every time the press bed starts and stops will naturally subject the teeth to more or less severe and uneven shock, with the result that wear will be excessive or, in extreme cases, the teeth might be stripped or chipped.

Effective Gear Lubrication Most Essential

All this can be prevented by keeping the teeth well coated at all times with a good adhesive, heavy-bodied lubricant, which will not only resist squeezing out but will be capable of furnishing a sufficient cushion to prevent metal-to-metal contact, however severe the operating conditions. There must be no tendency towards excessive fluidity even under abnormal temperatures; this will insure permanence in the film of lubricant and will reduce throwing.

Other Wearing Elements On The Flat Bed Press

In addition to the "Star Wheel" the flat bed press also carries an assembly of bearings, cams, rollers, smaller gears and chains.

Bearings

Where bearings are externally heated as for example at the ends of ink rollers, etc., they are often fitted with reservoirs in the top bearing cap or to one side of the base. These reservoirs are customarily packed with waste and designed for oil saturation at regular intervals. All bearings are not so accessible, however, for some are located beneath the press. To serve these, suitable piping is usually run from the holes in the bearing caps to the side of the press. Either oil or grease can be used according to the means of lubrication and the type of bearing.

On certain flat bed presses, special attention must be given to such parts as bed motion shaft boxes, flywheel shaft boxes, cylinder and eccentric boxes. In fact, any bearing part located adjacent to the side frame or set in a close fit between the side frame jaws as are all types of cylinder boxes, require regular and careful lubrication. Any impairment of lubri-

cation at these points may cause roughening of the wearing surfaces, etc., with the possibility of the cylinder being unable to take its full lift. This would affect the register or proper correspondence of the lines, etc., on opposite sides of the printed sheets.

The Lubricants To Use

For flat bed press bearing lubrication straight mineral oils of medium viscosity (viz: from 300 to 500 seconds Saybolt at 100 degrees Fahr.,) or medium consistency greases are suitable according to the means provided for application.

The sight feed or mechanical force feed oiler is suited to oils of this nature. The choice of grease, however, should be made with consideration of the type of bearing and the means of lubrication. One should never use lubricants which show any tendency to gum for ultimately the bearing grooves or races will become clogged to interfere with distribution of the lubricant.

Cams and Chain Links

Cam surfaces and chain links can also be effectively lubricated by a medium viscosity oil, or, if desired, by means of a grease of the type suited for ball bearings. On such parts, however, throwing of the lubricant must be guarded against as much as possible. In fact, on some types of presses not expressly designed for protected lubrication, a certain amount of lubricant will always drain through plain bearings and find its way out along the end of the shafts to ultimately drip upon the mechanism below, or onto the floor. As a result, there will practically always be a certain amount of free lubricant in the process of dripping and interior cams, gears, and chains will receive their share. So there is usually but little chance of any such mechanisms being underlubricated, provided the bearings above receive sufficient lubrication.

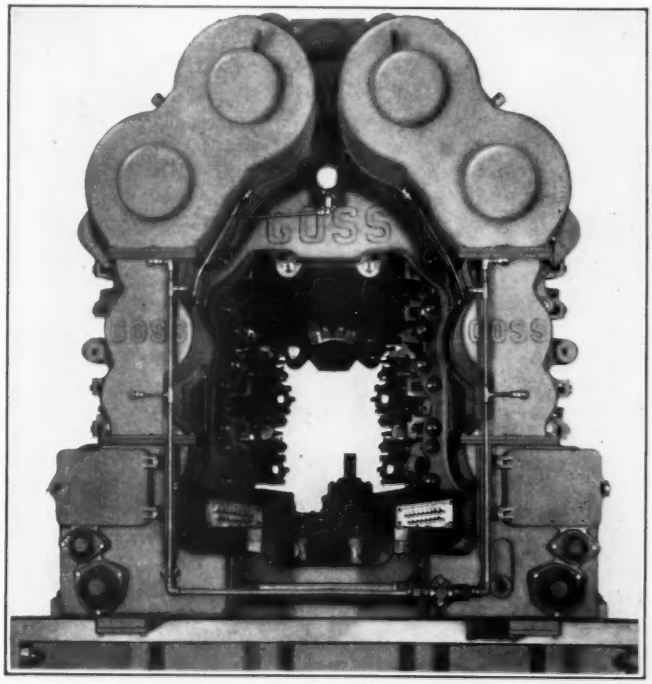
Light or medium lubricants on gears are not always advisable especially if heavy gear lubricants have been used first, mixture of the two may present more or less of a problem for the gear lubricant may be so thinned down by oil as to destroy its adhesiveness and protective ability.

For this reason many pressmen prefer a relatively heavy grease with sufficient soap content to insure against too great a reduction in the body of the lubricating film. Others rely on the press oil to lubricate their gears, oiling the latter with the same care and regularity they observe for their bearings. On lighter gears, oil will prove a very dependable lubricant, but the heavier roll gears will usually function with less noise, less wear and greater efficiency if a more viscous lubricant is used.

Lubrication Procedure

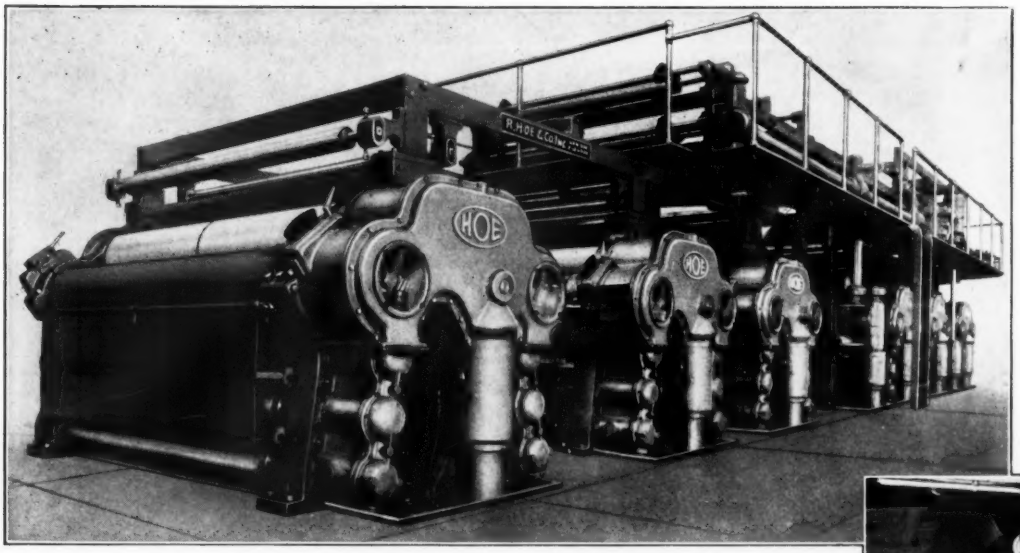
Press lubrication must be attended to regularly if best results are to be obtained. The flat bed press being very often a hand lubricated machine exemplifies this fact. There is usually no lubricant reservoir of any extensive capacity installed in connection with such a press. As a result, the human element is practically the deciding factor, and the care and regularity with which the press mechanisms are lubricated will be a measure of the operating efficiency, rate of production attained and power consumption.

In carrying out press lubrication the essential point to keep in mind is the function of each part requiring lubrication. It is not enough to simply squirt oil miscellaneously into every oil hole in sight or to sluice the gears or bearings. This will only waste oil and cause both the



Courtesy of The Goss Printing Press Co.

Fig. 5—Operating side of a Goss newspress equipped for automatic lubrication. Note the pipe lines which extend to the various elements. The oil reservoir is located at the lower right side of the base, from here lubricant is pumped to the gear trains. Other parts which require grease are pressure lubricated through suitable fittings.



Courtesy of R. Hoe and Co., Inc.

Fig. 6—The Hoe Super Production newspress, showing relative simplicity of the exterior when all guards are in place. This press is distinctive for its automatic lubrication features.

machine and floor to become an oily mess and endanger the safety of the operators. It is far better to recognize that every pair of surfaces in contact with each other possess a certain relation in their motion with respect to each other and therefore require a certain definite amount of lubrication at the points of contact in order to reduce solid friction as much as possible. Practice and observation will enable one to determine the requirements and to apply lubricants accordingly.

Press Design a Controlling Element

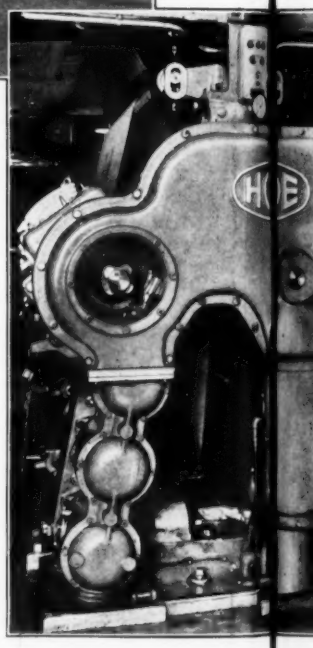
All this must be predicated however on the design and age of the press. Obviously a new press will require somewhat more oil and greater frequency in its application than one which has been in operation long enough to work all its mechanisms into a "running fit."

Ink rollers must also be studied. Difficulty may sometimes be encountered in press operation by bursting of such rollers at the ends, especially when running short forms on a flat bed press. Here considerable friction may develop between the ends of the rollers and the dry surface of the ink plate. In such cases, it is advisable therefore to coat the plate beyond the inking line with a light or medium bodied grease in order to insure against abnormal friction arising. Maximum production with minimum power consumption will be assured and the life of rollers can be materially lengthened by strict observance of this rule.

Putting The Press Into Operation

When starting up a flat bed press, it is advisable always to turn it over by hand a few times before throwing on the power to be sure that the proper "feel" at the wheel is present.

A competent press operator can develop a sense of judgment in regard to this "feel" which is of inestimable value in checking up on lubrication. In fact quite as essential as a knowledge of all parts requiring lubrication is the ability to judge whether these parts are functioning with a minimum of friction.



Courtesy of R.

Fig. 7—Shows oil tight housing of a Ho Press Unit. Port holes equipped with nor indicate the continuous bath of oil which p moving parts against wear. The oil gauge top of the unit is a reminder of lubrication been eliminated.

Overhaul Procedure

When the press is used intermittently, it will be advisable to rinse out bearings, oil holes and waste pad reservoirs with kerosine at frequent intervals, especially if dirt or dust is prevalent in the pressroom or when certain grades of paper are used which develop "fluff." All this must be removed otherwise obstructions will accumulate to interfere with delivery of the oil to the contact parts.

THE NEWS PRESS

News printing is done on the modern web press, the latter being so designated because

the paper is fed to it in a continuous sheet or web from a roll. The web press today is usually a rotary cylinder machine wherein the plates of typographical matter are curved to the periphery of the type cylinders and retained thereupon in proper relation to each other by means of a suitable locking device which is set when the press is made ready.

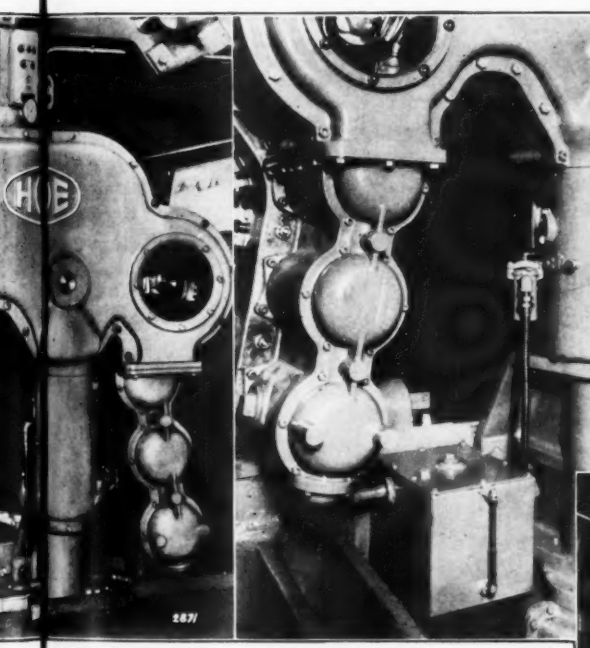
A news press is a complete producing unit in itself, by virtue of the fact that it can be so constructed as to print the paper on both sides, cut the printed web into pages along the proper margins, collect the necessary number of pages in numerical order into insets of desired size, fold the completed sets and deliver them ready for distribution by the newsdealers.

Speed of output can be realized by noting that the latest types of high speed presses can produce up to 120,000 papers per hour of a maximum of 16 pages inset, or 30,000 per hour of a maximum of 64 pages collected. The production of such a press when applied to the printing of magazine insets for newspapers is also of interest. Typical examples of such work are the comic sheets and colored supplements in our Sunday papers. One of the largest presses of its kind in the world is capable of printing in from one to four colors and the maximum production ranges from 144,000 8-page 2-color insets to 36,000 16-page, 4-color insets per hour. Varying combinations are also possible in between, depending upon the number of pages and color arrangements involved.

How Lubrication Affects Operation

One must appreciate the importance of lubrication to understand the details of operation of a modern high speed octuple news press. Obviously the former will play an important part in regard to speed of production and cost of maintenance.

Four distinct printing sections or units are involved in such a newspress; they are located in pairs at each end of the machine. Between these units are the folding devices. There are two plate cylinders to each unit; upon these the curved stereotype plates are securely locked in place; opposed to the plate cylinders are the impression cylinders which serve to press the paper against the former, their surfaces being covered with blankets made especially for obtaining the proper impression. Each plate cylinder carries eight stereotype plates each the size of a full newspaper page, so the entire press has a

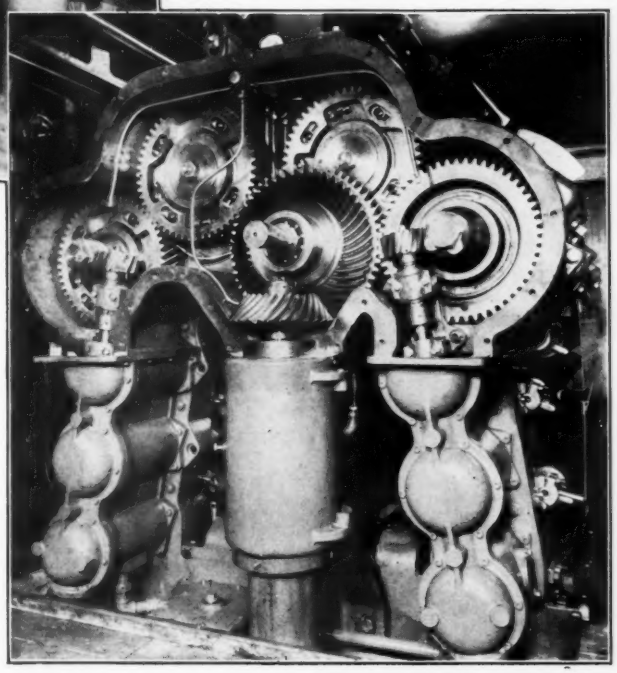


Courtesy of R. Hoe and Co., Inc.

Fig. 8—Showing the oil reservoir with sight-feed gauge and oil filter incorporated in the supply line.

Courtesy of R. Hoe and Co., Inc.

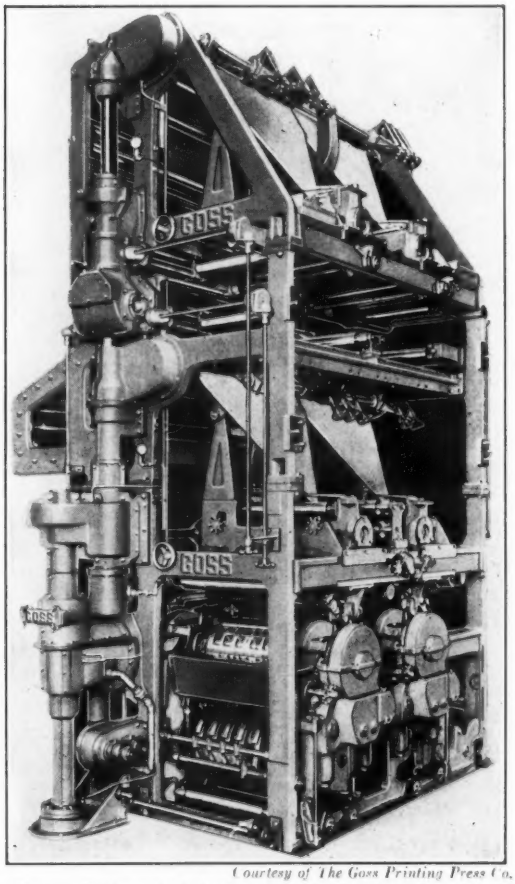
Fig. 9 (below)—The gearing on a modern Hoe newspaper unit with the face of the guard removed. Note the piping used to direct the flow of oil to the individual parts.



capacity of sixty-four plates or pages of newsprint when "fully dressed" or ready for maximum production.

The Inking Mechanism

Ink distribution is an important feature in web press operation. According to the type of press this may involve either a set of individual ink rollers for each unit, which take their ink supply from an adjacent fountain, or a patented pump system of ink distribution whereby the ink is pumped from a supply tank in individual streams (one for each column of print) to the ink distributing cylinders. This latter device eliminates the ink fountain with its accessory lifting rollers. In detail such a pump is usually composed of thirty-two small pumps, much on the order of a mechanical force feed lubricator. These pumps work in unison, being directly connected to the distributing cylinder which in turn is driven from the plate cylinder which it serves. Thus the amount of ink supplied is always in direct proportion to the speed of the press. Each individual pump is capable of independent adjustment.



Courtesy of The Goss Printing Press Co.

Fig. 10—Folder end of the Goss press showing the variety of mechanisms requiring lubrication. All enclosed gears with their attendant shafts are pressure lubricated by oil of characteristics suited to the type of gears employed. Other bearings are pressure grease lubricated.

Where an ink fountain is involved each unit is equipped with its individual set of accessory ink rollers. In such an arrangement the ductor or lifting roller alternately dips into the fountain, the ink being subsequently transferred to the distributor rollers which are arranged to travel from side to side across the distributing cylinder with relation to each other, as on a flat bed press. Even distribution and complete breaking up of the ink is thus insured. This vibrating motion is attained by means of suitable cam mechanisms.

Handling of the Paper

The webs of paper which come in rolls approximately six feet long and about thirty-two inches in diameter are placed either below each press section or at the end of the press, according to the design. In operation, the paper passes in a continuous sheet between the plate and impression cylinders where it is printed first on one side and then on the other.

From the press sections the webs or sheets then pass over rollers to the folding mechanism and after being slit along the center, travel over a "V"-shaped former where the first longitudinal fold is brought about. These folded sheets are then cut to page size by a revolving knife cylinder, after which they receive their second or half-page fold.

The final step is their delivery onto an endless belt arrangement ready for distribution to the readers. The novel feature of this delivery is the device which pushes out every fiftieth paper a little in advance of the others to simplify counting.

In general construction the web press involves much the same mechanical details such as bearings, gearing, and cam devices, as the flat bed press, with the exception that there is no reciprocating motion involved. Therefore, air cushions, bed rollers and tracks are eliminated. The magazine electrotype web press embodies practically the same principles of operation as the newspaper press.

How Lubrication Affects Production

With an understanding of the functions and operating principles of the modern web press one can realize the importance of proper lubrication. Most press builders have appreciated this fact and today they equip all important bearings of their machines with self-oiling or anti-friction bearings, and guard all gears as effectively as possible not only for the safety of the operators but also to improve the retention of the gear lubricant. (See Figs 5-9, incl.)

The web press involves an intricate assembly of bearings, gears and cams; all are so definitely dependent upon the others that any interference with operation would affect the pro-

duction of the machine as a whole. In other words, a stripped gear, a burned out bearing, or a worn cam anywhere on the press might easily cause partial or complete shutdown, for such parts cannot usually be renewed or repaired during operation.

Advent of the Ball and Roller Bearing

To enable more dependable operation a definite trend has been directed toward the use of ball and roller bearings in printing press construction. It is customary to mount the printing cylinders as well as the folding and cutting cylinders in roller bearings, and all other rotating parts such as pipe and compensating rollers or the rollers over which the web passes in going through the folders, in ball bearings. Here it is essential on such equipment to eliminate the possibility of smudging.

Lubrication of the average ball or roller bearing will depend upon the nature of its housing. Where this latter is oil tight, the bearing can be adequately served by a light bodied straight mineral oil. Usually a viscosity in the neighborhood of 300 to 500 seconds Saybolt is advisable. Where it is not possible to use oil, however, a medium consistency grease will be found satisfactory. Grease can be more readily retained than oil so wherever the seals will not warrant use of the latter, a grease especially prepared for anti-friction bearings should be used. This should be a low-torque product to insure minimum drag, and resistance to oxidation to prevent gum formations.

Heavy Bearings Designed for Self-Oiling

The bearings which carry the main, intermediate and folder driving shafts, are today generally built extra heavy and equipped with either ball bearing or self-oiling pillow blocks below the bed plates.

Where self-oiling bearings are concerned there is little or no possibility for wasted oil, and with the reservoir once charged, effective lubrication should be assured for extended periods. For such service a straight mineral lubricating oil having a viscosity of from 300 to 500 seconds Saybolt at 100 degrees Fahr., will generally meet the operating requirements.

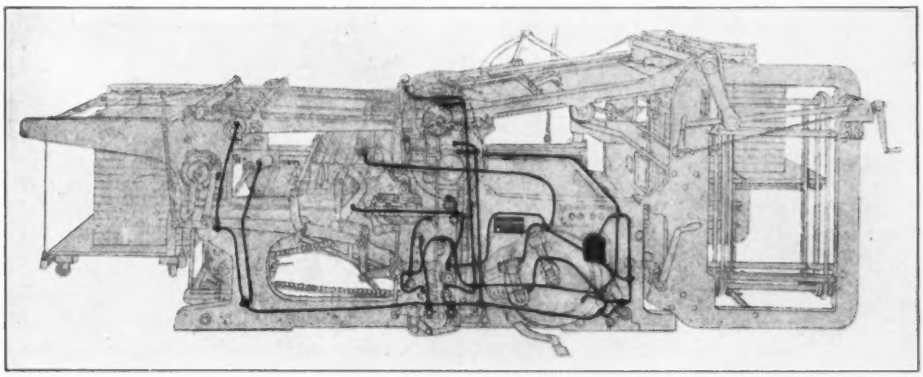
On presses of older construction, plain and open bearings are in use on practically all pipe rollers and other shafting. In certain presses they are installed throughout the machine. Here the press oil recommended above for self-oiling bearings will be quite suitable.

Gear Lubrication

This tendency of fluid oils to drip from plain or open bearings may often impair effective gear lubrication in the newspress, just as in the flat bed press, due to the possibility of such oils washing off the gear compounds which are usually applied. Guarding the gears is advantageous to a certain extent but guards will not always protect the gear teeth completely.

Heavier gears require a viscous heavy bodied gear lubricant. Many of such compounds are readily reduced by oil and rendered ineffective in a short time. Even certain soap thickened products such as greases suffer likewise.

The problem of press gear lubrication may be said therefore to involve a condition wherein the grade of lubricant must be selected more or less subordinately to the mechanical construction of the press bearings and the installation of adequate gear guards. Of course, on all gearing, wherever possible, a straight mineral, heavy bodied gear lubricant will prove most adaptable by virtue of its economy and adhesive characteristics and its ability to resist squeezing out from between the teeth under abnormal pressures. Such lubricants require greater care in application, however, an item



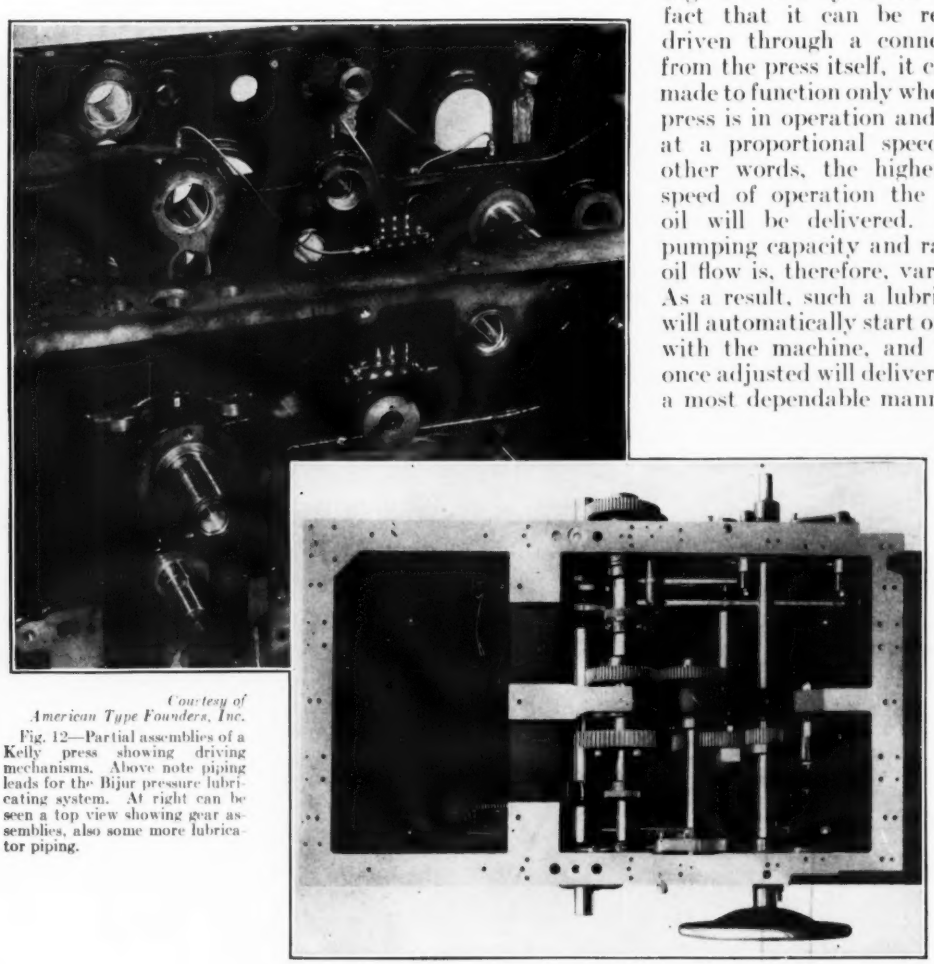
Courtesy of Miller Printing Machinery Co.

Fig. 11—Phantom side view of the Miller Automatic. This press is designed for automatic oiling, the necessary piping from the lubricator being indicated in heavy outline. Lubrication in this manner assures of positive delivery of a controlled amount of oil at sufficiently frequent intervals to assure of protection of the parts thus serviced.

which is not always encouraged by the pressman.

AUTOMATIC LUBRICATION REGARDED WITH FAVOR

With the development of the modern high speed press a marked trend has been directed towards the adoption of automatic means of lubrication. This has involved both oiling and greasing devices. Of the former, the mechanical force feed oiler, the centralized oiling system and the wick oiler have been, perhaps, the most extensively tried out. For the handling of heavier products, the spring type grease lubricator and pressure gun have proven adaptable.



Courtesy of American Type Founders, Inc.

Fig. 12—Partial assemblies of a Kelly press showing driving mechanisms. Above note piping leads for the Bijur pressure lubricating system. At right can be seen a top view showing gear assemblies, also some more lubricator piping.

The Mechanical Force Feed Lubricator

The mechanical force feed oiler involves one-time lubrication in very much the same manner as an oil cup or drip feed oiler. It, however, delivers more nearly the requisite amount of oil to meet the bearing requirements under a certain amount of pressure. If due care is observed when installing and the oil feed is properly adjusted, such lubricators are dependable and decidedly economical.

This type of lubricator has a further advantage in that, by virtue of the fact that it can be readily driven through a connection from the press itself, it can be made to function only when the press is in operation and then at a proportional speed. In other words, the higher the speed of operation the more oil will be delivered. The pumping capacity and rate of oil flow is, therefore, variable. As a result, such a lubricator will automatically start or stop with the machine, and when once adjusted will deliver oil in a most dependable manner.

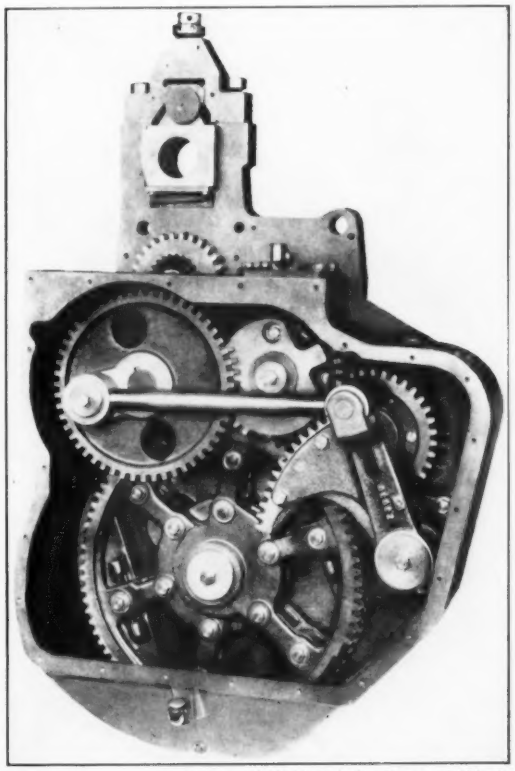
It is practicable to drive the pumps of such a lubricator by direct connection from any external moving part. This can be brought about by a link mechanism, through belt connection or by means of an eccentric attachment to some rotating element.

There is more or less of a limitation, however, to the use of a mechanical force feed oiler, in that the capacity is oftentimes comparatively small commensurate with the machine requirements. As a result, such a device must be refilled with oil at frequent intervals, depending on the speed of operation, the number of oil feeds and the rate of oil delivery. This

latter must be worked out in actual practice according to the number of parts to be lubricated and the nature and degree of refinement of the oil being used.

Constructional Details

The typical mechanical force feed oiler consists of a bowl or reservoir of varying capacity



Courtesy of Miehle Printing Press and Mfg. Co.

Fig. 13.—Gear case of a Miehle press showing method of housing to protect lubrication, and the oil level indicator.

ranging normally from one pint to two gallons. Within this reservoir, or attached thereto, is the pumping element or block. To this latter is attached the operating ratchet, clutch or belt connection.

The design of pump employed will depend upon the type of lubricator. In general, it will involve a piston or plunger. According to the service involved, quite a number of such pumping units can be embodied in the one lubricator. Furthermore, this latter can be divided into two or more parts so that more than one grade of oil can be delivered by the same lubricator. Where this latter prevails, however, care must be observed in filling in order to make sure that the right oil is always put in the proper compartment.

Actual operation of the pumping element is brought about by an eccentric or cam located usually within the reservoir. It receives its motion through the exterior operating mechanism such as the ratchet. It is practicable to arrange the design so that each pumping unit will operate independently, and capable of individual regulation. In order that the extent of lubrication or rate of pumping can be observed, oil is delivered from the pump unit through a suitable gauge glass or sight feed device. The purpose of locating this latter in the discharge line is, of course, to enable observation of oil flow, as the lubricator is functioning.

Centralized Pressure Lubrication

The operating principles of a typical centralized pressure oiling system will also be of interest. As a general rule, such a system of, automatic lubrication functions by virtue of a central control, all wearing parts so served being flushed and supplied automatically with oil from a central tank or reservoir.

As a general rule, this latter is located adjacent to the machine to be lubricated, and within ready reach of the operator. It is equipped with a suitable plunger which operates the pump. Lubrication of all parts connected thereto becomes but a matter of turning a hand wheel, pulling a plunger or pressing a button. The frequency with which this should be carried out will depend upon the speed of the press, the size of the bearings and the length of time the press is operated. In centralized pressure lubrication, the amount of oil fed is restricted to as nearly as possible the theoretical lubricating requirements of the respective bearings. As a result, it may readily be classified as a "fresh oil" system with the possibility of providing means for oil recovery and reclamation.

The fact that certain bearings will vary from others in regard to their oil requirements renders it necessary to provide for some arrangement of regulation or control of oil flow. Practically this amounts to a metering of the oil in terms of drops. It can be brought about either by proper individual construction of the drip plugs, which on such equipment are also known as control outlets; by use of a control device located at the base of the pump; or by the installation of suitable adjusting manifolds at salient points in the system.

Where any such system is properly installed it becomes relatively fool-proof, exceedingly simple to operate, and an insurance that clean oil will be delivered to the respective bearings. It is essential, however, that all parts be of rigid construction and capable of withstanding jars, shocks, and temperature fluctuations, for while piping, etc., is guarded wherever possible, it is relatively impossible to absolutely protect

all parts from the chance of contact with external materials.

It is interesting to note that the possibility of entry of dust into such a system is quite as negligible as in a pressure grease lubricator. To further insure that clean oil is used, however, certain central oil reservoirs are equipped with suitable filtering media, such as a felt pad, which is claimed to effectively remove any foreign matter that may have entered the oil in the course of storage or handling prior to usage. Lubricating oils as received from, or delivered by, reputable oil refiners can be relied upon as being free from non-lubricating foreign matter and capable of giving maximum protection.

Wick Feed Oiling Systems

In contrast to the several methods of lubrication, which provide for protective oiling from a central point of control, the wick feed oiler as applied to the printing press, is an individual means of lubrication. In other words, one or more such oilers must be used to serve each bearing, although they can all be gathered together at one point of location on the side of the press, each being connected to its respective bearing or other wearing element by means of suitable tubing.

The wick feed oiler is entirely automatic, in that it will continue to feed oil just as long as there is any contained in the oil cup. On the other hand, where the press is to be intermittently shut down, this may develop into waste, for oil will be fed whether the machine is running or not. This, however, is overcome by installation of a suitable shut-off cock in the oil line. It is, therefore, only a matter of opening each cock when the machine is to be started, or shutting same when closing down. The only other attention required is refilling with oil.

Wick feed oilers are adjustable in their rate of oil flow according to the number of strands contained in the wick. These can be readily varied according to the bearing requirements, the size and speed of rotation.

Circulating Systems

In the more modern types of press construction the trend is toward the use of enclosed type housings with circulating lubricating systems such as indicated in Figures 7, 8 and 9. In systems of this kind the oil is contained in the main reservoir and is pumped by means of a rotary pump to all parts to be lubricated within the enclosed housings. The oil is returned by gravity through a return line to the main supply tank. A filter is introduced in the supply line as shown in Figure 8 to filter the oil thus insuring that only clean oil reaches the parts to be lubricated. While this type of circulating system with enclosed housings adds materially to the cost of press construction, it is the most economical in operation as it reduces oil consumption and wear on press parts to a minimum, thus practically eliminating maintenance costs on parts so lubricated.

Pressure Grease Lubrication

The pressure grease gun has also been widely adopted for press bearing lubrication, likewise, the compression cup and spring type lubricator, wherever interior parts are to be served automatically and where it is desired to use a heavier lubricant than oil.

The typical spring type of lubricator involves a combination of the pressure grease gun plus the spring type cup. As a general rule, by using a spring of particular tension in connection with a discharge orifice of suitable size, flow of grease therefrom can be very accurately controlled. Furthermore, it can be noted by observation of the indicator with which such lubricators are usually equipped.

Filling of such a cup is a simple and cleanly matter. It merely amounts to attaching the pressure gun to the fitting located in the base of the cup. There is no necessity for removal of the cover, as may be true with those cups which are more strictly of the hand pressure type. In consequence there is more positive assurance that the grease charge will not become contaminated through possible entry of dust or dirt. The next step is to charge grease into the cup until the indicator rises to its full height to show that the cup has been completely filled.

The initial pressure for such filling may be obtained by use of compressed air, electric power, or simply hand or foot power, according to the type of gun and the pressure desired. The former develop considerably higher pressures than the latter.

Where a relatively simple hand pressure grease gun is used, the impression may be gained that this should be classified with the hand pressure or screw-down type of cup. One must, however, remember that hand pressure applied to a grease gun does not react directly on the bearing; it must first be converted to mechanical energy by doing work in compressing the spring in the grease cup. From this point on lubrication is automatically maintained by the mechanical action of the spring upon the adjacent plunger which bears upon the grease charge to force it through the bearing.

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